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January 11, 2006

Mr. Edgardo Gillera
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, California 94710

RE: Revised Work Plan for *In Situ* Chemical Oxidation at Buildings 5 and 6
Former Watkins-Johnson Facility
3201-3251/3301-3307 Hillview Avenue, Palo Alto, California
SECOR PN: 05OT.02787.00.0004

Dear Mr. Gillera:

SECOR International Incorporated (SECOR) has prepared this Revised Work Plan to conduct *In Situ* Chemical Oxidation (Work Plan) at the former Watkins-Johnson (WJ) Site located at 3201-3251/3301-3307 Hillview Avenue in Palo Alto, California (Figure 1 – Site Location Map). In a letter dated December 6, 2005, DTSC provided SECOR with comments to the *Work Plan for In Situ Chemical Oxidation Pilot Study at Buildings 5 and 6, Former Watkins-Johnson facility*, dated October 26, 2005. In that letter, DTSC requested SECOR submit a Revised Work Plan addressing their comments. This Work Plan describes relevant Site background, a technology description, objectives, approach, detailed methods and procedures, and a schedule of work.

BACKGROUND

Two locations within Operable Unit 2 (OU2) at the former WJ Site were identified for groundwater remediation: 1) the Building 5 Upper Flow Zone System (Upper Flow System); and 2) the Building 6 Flow System. Although the two flow systems are distinct from one another, identical remedial measures were implemented for both because the geology is similar, well yield is low, and the extent of chemical impacts to groundwater are limited in the two systems. Since 1995, groundwater extraction and treatment systems (GWETS) have been operated at both Buildings 5 and 6. A map showing the former WJ facility layout, the location of Operable Units OU1 and OU2, and the Building 5 and 6 areas is presented in Figure 2.

Groundwater underlying both the Buildings 5 and 6 areas has been impacted by chlorinated volatile organic compounds (CVOCs). In the Building 5 Upper Flow System, the primary

CVOC present in groundwater is 1,1-dichloroethene (1,1-DCE). Other CVOCs reported in the Upper Flow System include 1,1-dichloroethane (1,1-DCA), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), and trichloroethene (TCE). 1,1-DCE concentrations are generally one to two orders of magnitude higher than other CVOCs reported in Upper Flow System groundwater. CVOCs found in the Upper Flow System appear to have originated from a source local to the Building 5 area, or are degradation products of other CVOCs. Groundwater data collected in November 2004 show 1,1-DCE concentrations remaining in the Upper Flow System range between 0.5 micrograms per liter (µg/L) to a maximum of 350 µg/L in well PA-40, which is completed between the Upper and Lower Flow Systems.

Groundwater in the Building 5 Lower Flow System has also been impacted by CVOCs. CVOCs detected in the Lower Flow System include tetrachloroethene (PCE), TCE, 1,1-DCE, 1,1-DCA, and *cis*-1,2-DCE. In the Lower Flow System, TCE concentrations typically occur at higher levels than those observed in the Upper Flow System. Conversely, concentrations of 1,1-DCE are generally lower in samples collected from the Lower Flow System. CVOCs in groundwater within the Lower Flow System are part of a regional groundwater plume which migrates from the saturated alluvial filled trough to the southwest of Building 5 into the transmissive gravel unit and dips downward towards Building 5. Accordingly, CVOC-impacted groundwater within the Lower Flow System is being monitored and remediated as part of the Hillview-Porter Region remedial measures. A conceptual diagram of the hydrogeology and CVOC sources and transport in the Building 5 area is depicted on Figure 3.

In the Building 6 Flow System, TCE is the primary CVOC detected in groundwater. Groundwater data collected in November 2004 show TCE concentrations remaining in the Building 6 Flow System range between 0.5 µg/L to a maximum of 25 µg/L in well PA-61R. CVOC-impacted groundwater at Building 6 is limited to a small area on the west side of Building 6. The source of CVOCs detected in groundwater at Building 6 is not known, but may be related to a historic release during earlier operations in the vicinity of a former loading dock. A hydrogeologic cross-section through the Building 6 area is depicted on Figure 4.

A discussion regarding potential alternatives to pump-and-treat was included in the *Second Five-Year Report, Former Watkins-Johnson Facility, 3201-3251/3301-3307 Hillview Avenue, Palo Alto, California (Second Five-Year Report),* dated April 1, 2005. As documented in the Second Five-Year Report, ten years of "pump-and-treat" at both Buildings 5 and 6 has significantly reduced CVOC concentrations in groundwater.

However, chemical concentration declines have shown to progressively lessen with time, indicating that pump-and-treat may no longer be the most effective remedial alternative to achieve groundwater cleanup goals established for the Site. Accordingly, it is recommended that alternatives to pump-and-treat be considered to cleanup the relatively low residual CVOC concentrations remaining in groundwater. Specifically, SECOR recommended discontinuing, on a trial basis, the operation of the pump-and-treat systems at Buildings 5 and 6 and implementing *in situ* chemical oxidation, using potassium permanganate ($KMnO_4$). The Department of Toxic Substances Control (DTSC) approved this recommendation and requested submittal of a Work Plan in a letter dated April 22, 2005. A Work Plan for *In Situ* Chemical Oxidation *was* submitted on October 26, 2005, and the DTSC issued comments in a letter dated December 6, 2005, which are addressed and incorporated herein.

TECHNOLOGY DESCRIPTION

$KMnO_4$ is a strong oxidant that reacts well with a variety of double-bonded chlorinated hydrocarbons such as TCE and its breakdown products. The dissolved compound is visible by its deep purple color and can therefore be easily monitored in wells, and is highly soluble in water (up to approximately 4 percent by mass), reacts well at high pH, and persists in groundwater longer than other chemical oxidants such as Fenton's reagent (hydrogen peroxide, ferrous sulfate, and acid). The slower rate of reaction of $KMnO_4$ reduces excessive gas generation which can reduce the permeability of aquifers.

$KMnO_4$ is a relatively stable compound and thus will remain longer in a contaminated aquifer increasing the effectiveness of each dosing. $KMnO_4$ reactions can generate acidity therefore, an aquifer with high alkalinity is ideal for $KMnO_4$ reactions. The persistence and high solubility in groundwater make $KMnO_4$ application simpler than other oxidants. $KMnO_4$ can be dosed in a single concentrated slug which can gradually permeate with groundwater and remediate the contaminated aquifer over time. The treatment plume permeates the aquifer and will provide destruction of contaminants in source sediments and groundwater. Post-injection monitoring data from other sites in Palo Alto show that $KMnO_4$ can persist in the aquifer for longer than one year and wells exhibiting purple to pink color and ORP values in excess of 400 millivolts (mv) do not typically contain detectable CVOCs.

Recent $KMnO_4$ treatment studies conducted by SECOR at other sites in Palo Alto with similar contaminants and hydrogeologic conditions have demonstrated favorable results and thus, it is likely that this technology will be successful in treating residual groundwater contamination at both Buildings 5 and 6. The largest challenge to successful implementation of *in situ* chemical oxidation at the Site is the low permeability of the aquifer materials (particularly at Building 5), which may make delivery of the oxidant to the subsurface difficult. However, given the relatively low contaminant concentrations and localized plume extent, adequate oxidant delivery may be achievable.

CHEMICAL OXIDATION APPROACH

The GWETS at both Buildings 5 and 6 will be shutdown on a trial basis during chemical injection and subsequent monitoring period, which will continue for a period of up to approximately one year. System shutdown will be accomplished in such a way as to allow reconnection and restart of major system components with minimal effort within approximately 2 to 4 weeks.

Following shutdown, a one-time injection of $KMnO_4$ solution using a combination of existing wells and temporary Geoprobe® borings as injection points will be completed at both Buildings 5 and 6. Due to the rapid rate of CVOC destruction following introduction of the $KMnO_4$ and the low hydraulic conductivity of flow zones targeted for treatment, the proposed temporary shutdown of the GWETS is not anticipated to result in any significant contaminant migration outside the treatment areas. Two additional monitoring wells (OBS-1 and OBS-2) will be added at Building 5 and one additional monitoring well (OBS-3) will be added at Building 6 to monitor any potential expansion of the plume during injection.

Approximately 800 gallons of 4 percent permanganate solution (approximately 275 pounds permanganate) will be injected into each location. This proposed dosage volume is based on previous SECOR experience with injection of permanganate at similar sites, an estimated soil oxidant demand (SOD) of approximately 1 gram per kilogram (gm/kg) soil, and dissolved contaminant concentrations present in the treatment zone.

Chemical injection activities will not interfere with normal depth-to-water measurement and sampling events scheduled for the WJ Site or Hillview-Porter Regional groundwater monitoring program.

Building 5

At Building 5, $KMnO_4$ injections will be completed using five existing wells and one temporary Geoprobe® injection point (total of six injection locations). Approximately 800 gallons of 4 percent permanganate solution (approximately 275 pounds permanganate) will be injected into each location. Injection into these six locations is expected to provide treatment throughout the portion of the Upper Flow System where 1,1-DCE concentrations exceed the cleanup goal of 6 µg/L. In the event the targeted oxidant distribution and/or volume cannot be achieved with the six proposed injection locations, additional injections into alternative temporary Geoprobe® boring locations will be considered.

As noted above and depicted on Figure 3, proposed injection well PA-40 is screened between the Upper and Lower Flow Systems. This well was included in treatment, as it is believed to be influenced by leakage from the Upper Flow System and 1,1-DCE is the primary contaminant present in this well. Building 5 injection locations and 1,1-DCE concentration data from November 2004 are depicted on Figure 5. Details regarding the six proposed injection locations, 1,1-DCE concentration data from November 2004, and a list of the proposed monitoring locations to be used during injection are tabulated below.

Injection Location	Well Diameter (in)	Total Depth (feet bgs)	Injection Interval (feet bgs)	Nov '04 1,1-DCE (µg/L)	Wells Monitored During Injection
PA-40	4	40.4	36 – 40	350	OBS-1, OBS-2, PA-43, PA-56, PA-30, deeper wells PA-18 and PA-29
PA-43	4	28.5	22.5 - 27.5	130	OBS-1, OBS-2, PA-40, PA-30, PA-56, deeper wells PA-18 and PA-29
PA-56	8	35.3	26.5 – 31	90	OBS-1, OBS-2, PA-43, PA-40, PA-30, deeper wells PA-18 and PA-29
PA-30	4	35	30 – 35	92	OBS-1, OBS-2, PA-56, PA-43, PA-40, PA-57, deeper wells PA-18 and PA-29
PA-57	8	47	36.25 - 41.75	17	OBS-1, OBS-2, PA-40, PA-30, PA-56, deeper wells PA-18 and PA-29
Temporary Geoprobe® Point	NA	40	30 – 40	NA	OBS-1, OBS-2, PA-57, PA-30, PA-40, PA-56, deeper wells PA-18 and PA-29

feet bgs: feet below ground surface
NA: not available or not applicable

Building 6

At Building 6, $KMnO_4$ injections will be completed using three existing wells and two temporary Geoprobe® injection points (total of five injection locations). Approximately 800 gallons of 4 percent permanganate solution (approximately 275 pounds permanganate) will be injected into each location. Injection into these five locations is expected to provide treatment throughout the portion of the Building 6 Flow System where TCE concentrations exceed the cleanup goal of 5 µg/L. In the event the targeted oxidant distribution and/or volume cannot be achieved with the six proposed injection locations, additional injections into wells PA-62R and PA-60R or alternative temporary Geoprobe® boring locations will be considered.

Building 6 injection locations and TCE concentration data from November 2004 are depicted on Figure 5. Details regarding the five proposed injection locations, TCE concentration data from November 2004, and a list of the proposed monitoring locations during injection are tabulated below.

Injection Location	Well Diameter (in)	Total Depth (feet bgs)	Injection Interval (feet bgs)	Nov '04 TCE (µg/L)	Wells Monitored During Injection
PA-61R	8	63	50 – 60	25	PA-26R, PA-62R and OBS-3
PA-26R	4	56.5	45 – 55	7.7	PA-61R, PA-62R, PA-55R, PA-63R and OBS-3
PA-55R	8	61.5	50 – 60	7.1	PA-62R, PA-53R, PA-61R, PA-26R, PA-45R and PA60R
Two Temporary Geoprobe® Points	NA	60	50 – 60	NA	PA-62R, PA-26R, PA-61R, PA-53R, PA-55R, PA-60R and PA-63R

feet bgs: feet below ground surface
NA: not available or not applicable

PROCEDURES

Task 1 – Well Preparation and System Deactivation, Pre-field Activities

A site-specific Health and Safety Plan (HASP) will be prepared to address all safety issues during field activities including spill abatement and containment, high pressure injection, permanganate handling, and transfer. A copy of the HASP will be provided to DTSC under separate cover prior to start of field activities. Underground Service Alert will be notified and a utility clearance subcontractor will be retained to identify locations of subsurface utilities and/or other obstructions in the area(s) prior to advancing Geoprobe® borings.

A hazardous materials permit(s) will be obtained from the City of Palo Alto, Fire Department and drilling and well installation permits will be obtained from the Santa Clara Valley Water District (SCVWD). A SCVWD well inspector will be scheduled for temporary permanganate injection boring abandonment and new monitoring well installation. SECOR will notify applicable agencies and interested or affected parties that system shutdowns will occur and include, at a minimum, site representatives from the DTSC, SCVWD, and the Palo Alto Regional Water Quality Control Plant (PARWQCP).

The existing GWETS will be shutdown during the proposed injection and monitoring period in such a way to allow restart of both systems within a period of approximately 2 to 4 weeks. Sensitive components will be serviced and placed into storage for potential future use, if possible. Pumps will be removed from wells, cleaned, and stored. Groundwater extraction conveyance lines will be shut-off and drained. Permanent pad equipment will be weatherized and prepared for shutdown. Poly carbon drums will be drained and left in place. Fittings and piping will be protected against sun damage, corrosion, and biofouling. Electrical and communication lines and control boxes will be locked out at the treatment compound and protected from moisture, rain, and sun damage. Treatment compound gates will be closed and locked.

Existing wellheads used for injection will be sealed with glue or other pressure rated fittings, and reducer fittings will be added as needed to accept available contractor permanganate injection piping. A safety piping harness, hold downs, and plastic sheeting will be used to protect against injury from spills or spray, and gauges will be added at appropriate piping locations to monitor injection pressures. SECOR will coordinate and schedule safe delivery and storage of the $KMnO_4$ solution in closed tanks on-site the day of injection.

Task 2 – Well Installation and Sampling

Prior to chemical oxidation treatment, two 2-inch diameter Upper Flow zone monitoring wells (OBS-1 and OBS-2) will be installed at Building 5 for the purposes of monitoring potential displacement of CVOC-affected groundwater during injection. One additional 2-inch diameter monitoring well (OBS-3) will be installed at Building 6 to provide a monitoring location downgradient from the treatment zone. Specifically, well OBS-3 will be used to confirm reduction of hexavalent chromium to trivalent chromium downgradient from the treatment zone. The locations of proposed additional monitoring wells are shown on Figures 5 and 6.

Proposed injection wells in the area of Building 5 are screened between 49 to 65 feet below ground surface (bgs) and in the area of Building 6 are screened between 38 and 51 feet bgs. Screened intervals for the new monitoring wells will be completed within the proposed injection intervals. The actual screened intervals will be selected based on hydrogeologic conditions encountered during drilling. The monitoring well boreholes will be advanced to maximum depths of 65 feet at Building 5 and 51 feet bgs at Building 6 using a truck-mounted drilling rig equipped with 8-inch diameter hollow-stem augers. During borehole advancement, soil samples will be collected continuously from approximately 5 feet bgs to total depth and logged by a SECOR geologist using the Unified Soil Classification System (USCS). Representative portions of soil samples will be field screened for VOCs using a photoionization detector (PID). A minimum of one saturated zone soil sample from the screened interval of each monitoring well will be retained and analyzed for total organic carbon (TOC) using U.S. Environmental Protection Agency (EPA) Method 9060. These data will be used to confirm SOD estimates.

The wells will be constructed of flush-threaded 2-inch diameter Schedule 40 PVC with an estimated 10 feet of 0.020-inch machine-slotted screen. The annular space between the well casing and borehole wall will be filled with an appropriate sand pack material to 1 foot above the top of the screen followed by a 2-foot bentonite seal. The remaining annular space will be finished to the surface with Portland cement slurry. Following installation, the wellhead will be fitted with a locking expansion cap and covered with a flush-mounted, traffic-rated utility box. The top of casing elevation for both wells will be surveyed by a licensed surveyor to a local benchmark location.

Prior to the initial sampling event, new groundwater monitoring wells will be developed by alternately surging and bailing the well. During development, approximately ten casing volumes of water will be removed and monitored for physical parameters including pH, temperature, and specific conductance (SC). Development and decon water will be contained, analyzed, and discharged through the existing groundwater treatment systems under the existing POTW permit or placed in labeled drums near the treatment area for future disposal off-site following federal, state and local regulations. Soil drill cuttings will be placed in secure and labeled containers, profiled, and similarly disposed off-site.

Task 3 – Permanganate Injection Field Work

SECOR field personnel will oversee chemical handling, tank filling operations, transfer and storage, injection rig operation, point installation, and site cleanup. SECOR will retain an injection contractor; coordinate equipment and piping connections; inspect contractor equipment; and schedule the shipment, storage and delivery of pre-mixed potassium permanganate solution.

Approximately 3,100 gallons of permanganate tank storage capacity will be available at each building location. Tanks and secondary containment will be field-located near the center of the injection area at each building. Temporary fencing will be placed around the contained tank storage area and removed upon completion of injection work. The chemical storage area will be properly placarded and secured. Tank chemical storage will be on a secondary-contained pad, consisting of 10 mil HDPE chemical resistant, formed plastic sheeting to catch any spills during transfer of chemical. Chemical handling and safety procedures will be in-place during chemical injection (PPE, valve and operation instructions and sequence, worker and public buffer zones) to prevent over-pressurization, fitting and hose failures, spills, and to protect workers from potential exposures.

Sodium meta-bisulfite will be on-hand in sufficient quantity to neutralize spills and protect pavement and equipment. Sufficient socks and absorbent pads will be available and placed around storm drains and near sensitive landscaping. The injection and surrounding area will be blocked off with caution tape and barricades to prevent pedestrians and cars in the work area.

Existing 4-inch and 8-inch monitoring and extraction wellheads will be sealed to allow increased injection pressures into well screens at depth (up to 40 psi maximum pressure, measured at the wellhead). Injection into Geoprobe® locations will be through 1.5-inch Geoprobe® well casing and will begin at final depth and progress upwards as the casing is removed. Following injection, Geoprobe® borings will be grouted to surface in accordance with SCVWD requirements. Well casing fittings will be cut or removed and top-of-casing elevations will be measured in the field and recorded (if altered during removal of injection fittings) to ensure accurate future reporting of well specifications and groundwater elevations.

The injection rig will position itself near each injection location and connect a hose to transfer $KMnO_4$ solution into each wellhead from nearby storage tanks. $KMnO_4$ solution will be injected into each well or boring location at average injection rates ranging from approximately 7 to 10 gallons per minute (gpm; conservatively 5,000 gallons per day) depending on soil permeability. Well pressures will not exceed 40 psi to protect the integrity of well packing and prevent possible surface rupture. Depth-to-water and color will be periodically checked at nearby monitoring wells with similar screened intervals and in deeper wells (PA-18 and PA-29) during the injection process as indicated in the tables above to assess the distance and direction of permanganate flow. Depth-to-water will be measured using an electronic water-level indicator. Color change will be assessed by lowering a clear bailer to the base of the screened interval, retrieving the bailer, and visually inspecting water color. Injection will occur over an approximately 3-day period at Building 5 and over an estimated 2-day period at Building 6.

Task 4 – Baseline and Post-Treatment Groundwater Monitoring

Baseline and post-treatment monitoring will be performed to evaluate the effectiveness of the treatment. When collecting groundwater samples for chemical analysis, well purging and sampling will be conducted following a low-flow purging technique detailed in an attachment to this Work Plan. Details of the injection monitoring program are provided below.

Baseline Monitoring for CVOCs

For all monitoring/injection wells, except the three new monitoring wells (OBS-1 through OBS-3), groundwater monitoring conducted in November 2005 will serve as baseline (pre-treatment) groundwater data for CVOC concentrations. Baseline monitoring for CVOC concentrations will be completed for the two new monitoring wells at Building 5, OBS-1 and OBS-2, and the new monitoring well at Building 6, OBS-3, following installation and development and prior to performing the injections. Groundwater samples will be submitted under chain-of-custody to a state-certified testing laboratory and analyzed for CVOCs using EPA Method 8260B.

Baseline Monitoring for Hexavalent Chromium

During the November 2005 monitoring event, groundwater samples were collected from one well within each treatment zone (PA-56 in Building 5 and PA-61R in Building 6) and analyzed for hexavalent chromium using EPA Method 7196. Data from these wells will be used as baseline for the treatment zones. To provide baseline hexavalent chromium data from wells downgradient of the treatment zones, monitoring well PA-59 at Building 5 and the new well OBS-3 at Building 6 will be sampled and analyzed for hexavalent chromium using EPA Method 7196 prior to performing the injections.

Post-Treatment Monitoring

Upon completing $KMnO_4$ injection, a post-treatment monitoring program will be initiated to monitor $KMnO_4$ persistence and contaminant destruction effectiveness. Post-treatment monitoring events will be conducted after two weeks, one month, six months, and one year following injection and include ten wells at Building 5 (two newly installed monitoring wells OBS-1 and OBS-2 and existing wells PA-18 and PA-29, PA-30, PA-40, PA-43, PA-56, PA-57, and PA-59) and nine wells at Building 6 (one newly installed monitoring well OBS-3 and existing wells PA-26R, PA-45R, PA-53R, PA-55R, PA-60R, PA-61R, PA-62R, and PA-63R). During each post-treatment monitoring event, groundwater in all wells identified above will be visually inspected for evidence of permanganate (purple color) by lowering a clear bailer into the base of the screened interval, retrieving the bailer, and visually inspecting the water for color. If no visible evidence of permanganate is observed, an ORP measurement of the water will be collected in the field using a handheld meter.

In addition, selected wells at each building will be sampled for the following:

Monitoring Period After Injection	CVOC Analysis Building 5 Wells	CVOC Analysis Building 6 Wells
2 Weeks	OBS-1, OBS-2, PA-59, PA-18 and PA-29	PA-63, PA-45R and PA-53R
One Month	PA-30, PA-40, PA-43, PA-56, PA-57	PA-26R, PA-55R, PA-60R, PA-61R and PA-62R
6 Months	PA-30, PA-40, PA-43, PA-56, PA-57	PA-26R, PA-55R, PA-60R, PA-61R and PA-62R
12 Months	PA-30, PA-40, PA-43, PA-56, PA-57	PA-26R, PA-55R, PA-60R, PA-61R and PA-62R

As shown above, during the first two-week monitoring event, groundwater samples from five wells (including Lower Zone wells PA-18 and PA-29) at Building 5 and three wells at Building 6 will be collected and submitted to a state-certified laboratory for CVOC analysis by EPA Method 8260, regardless of color. Data from these wells, which are located outside the anticipated treatment zone, will be used to assess potential displacement of CVOC-affected groundwater resulting from the injection process. Should results of sampling show notable increases in CVOCs in one or more wells, SECOR will recommend additional monitoring at that time. During the one-month, six-month and one-year monitoring event, samples will be collected from wells located within the anticipated treatment zone (five wells each at Building 5 and Building 6) and analyzed for CVOCs, regardless of color. Any purge water generated will be contained and discharged through the existing groundwater treatment systems under POTW permit or placed in labeled drums near the treatment area for future disposal off-site following federal, state and local regulations.

Hexavalent Chromium Evaluation

During each post-injection monitoring event, any well exhibiting visible evidence of elevated hexavalent chromium (yellowish-green color) will be sampled and analyzed for hexavalent chromium. During the 12-month post-treatment monitoring event, groundwater samples from wells PA-56 and PA-59 at Building 5 and PA-61R and OBS-3 at Building 6 will be sampled and analyzed for hexavalent chromium to evaluate post-treatment hexavalent chromium concentrations.

SECOR will forward a table of field results to the DTSC for comment following each post-treatment monitoring event. Should unexpected conditions or results be encountered at any time during post-treatment monitoring, SECOR will forward the suspect results to the DTSC with any proposed changes to the post-treatment monitoring program, if needed.

Periodic Monthly System Treatment Pad Checks

SECOR will visit the site monthly and inspect remaining system components in each shutdown treatment area to ensure the system is properly maintained and can be readily restarted within a reasonable timeframe at a future date. Treatment pad checks will include inspection of control and electrical housings for moisture, excessive UV damage, and cracking of piping and tanks. Valves will be opened and closed during each visit. Unusual wear will be reported and damaged components repaired or replaced in order to keep systems operational.

Task 5 – Data Analysis and Reporting

Sampling and analysis results will be submitted to the DTSC in tabular format following each post-injection monitoring event. A letter report describing implementation of the Work Plan and including the two-week and one-month post-treatment monitoring event data will be prepared and submitted to the DTSC. A final report describing results, conclusions, and recommendations will be prepared and submitted to the DTSC following the one-year post-injection monitoring event.

SCHEDULE

The following schedule is proposed following formal Work Plan approval:

3 weeks	Task 1 – Well Preparation and System Deactivation, Pre-field Activities
1 week	Task 2 – Well Installation and Sampling
2 weeks	Task 3 – Permanganate Injection Field Work
52 weeks	Task 4 – Baseline and Post-treatment Groundwater Monitoring
4 weeks	Task 5 – Data Analysis and Reporting

We hope this Revised Work Plan meets with your approval and is consistent with your expectations. If you have any questions or comments regarding this Revised Work Plan or concerns regarding these activities, please contact the undersigned at (925) 299-9300.

Sincerely,

SECOR International Incorporated

Mario Sternad

Mario Sternad, P.E.
Senior Engineer

Bruce E. Scarbrough

Bruce E. Scarbrough, P.G.
Principal Geologist

REGISTERED GEOLOGIST
BRUCE SCARBROUGH
No. 4931
Exp. 10/07
STATE OF CALIFORNIA

cc: Roger Papler, RWQCB – San Francisco Bay Region (Electronic Submission)
George Cook, Santa Clara Valley Water District (FTP Upload)
Dan Firth, City of Palo Alto Fire Department
Annette Walton, Stanford Management Company
Mark Bringuel, WJ Communications
Rick McNeil, Irell & Manella LLP

List of Attachments:

Figure 1 – Site Location Map
Figure 2 – Former Facilities Layout Map
Figure 3 – Conceptual Diagram of Hydrogeology and VOC Transport in the Building 5 Area
Figure 4 – Hydrogeologic Cross-Section Building 6 Area
Figure 5 – Proposed Injection Locations - Building 5
Figure 6 – Proposed Injection Locations - Building 6

Attachment – Low-Flow/Low Volume Purging and Sampling, Standard Operating Procedure

1 1/2 0 1

SCALE IN MILE

1000 0 1000 2000 3000 4000 5000 6000 7000

SCALE IN FEET

SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC MAP
NILES, CALIFORNIA
(1961, PHOTOREVISED 1980)

SECOR
57 LAFAYETTE CIRCLE, 2nd FLOOR
LAFAYETTE, CALIFORNIA
Phone: (925) 299-9300 FAX: (925) 299-9302

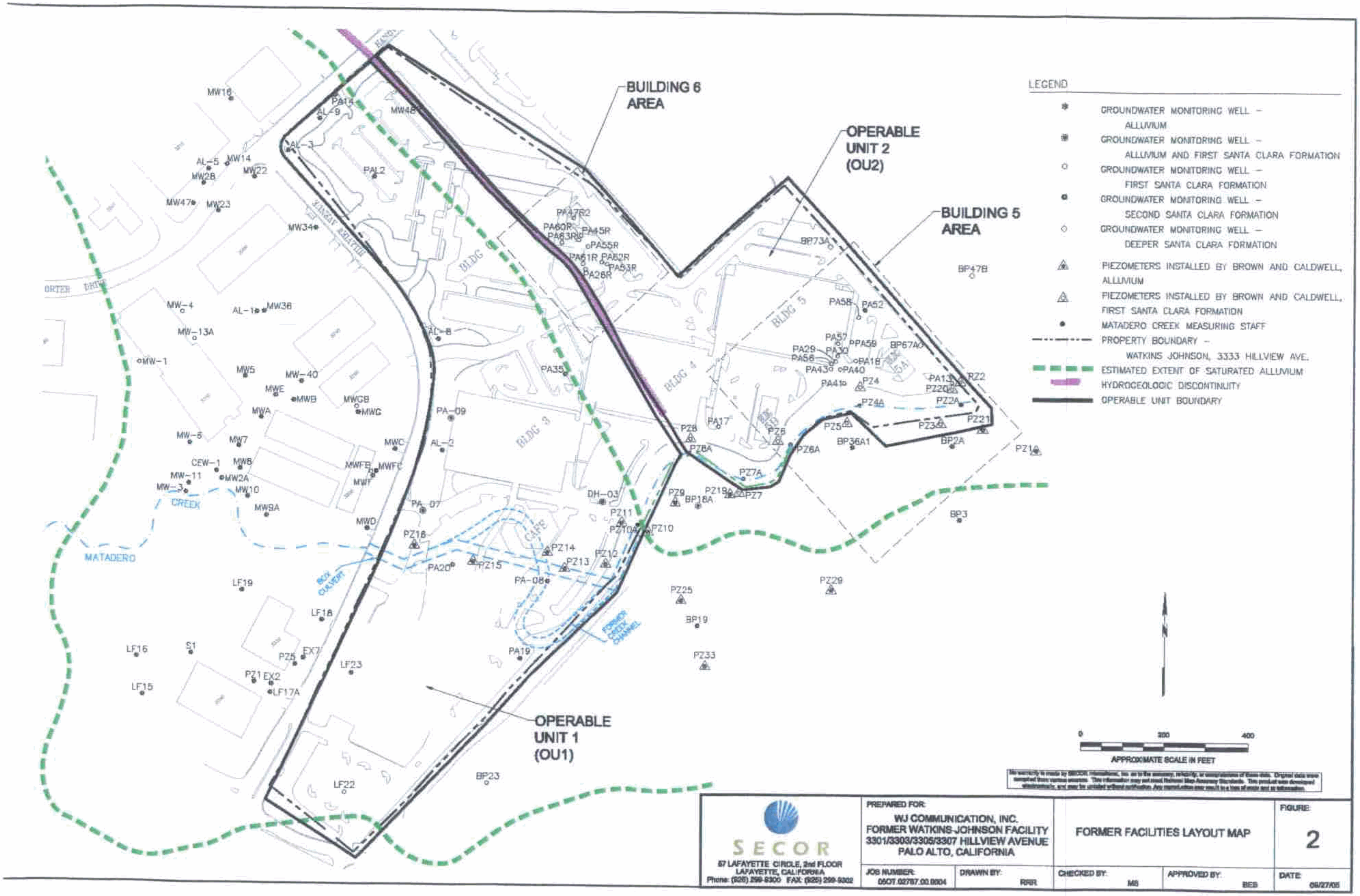
PREPARED FOR:
WJ COMMUNICATION, INC.
FORMER WATKINS-JOHNSON FACILITY
3301/3303/3305/3307 HILLVIEW AVENUE
PALO ALTO, CALIFORNIA

SITE LOCATION MAP

FIGURE: 1

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
05OT.02787.00.0004	RRR	MS	BES	09/27/05

FILEPATH:K:\Watkins-Johnson\sept 2005\Fig 1.dwg|rroggasch|Sep 28, 2005 at 9:47|Layout: FIGURE 1


BUILDING 6 AREA
OPERABLE UNIT 2 (OU2)
BUILDING 5 AREA
OPERABLE UNIT 1 (OU1)
BLDG 6
BLDG 5
BLDG 4
BLDG 3
CAFE
MATADERO
CREEK
BOX CULVERT
FORMER CREEK CHANNEL
KINGSLEY AVENUE
PORTER DRIVE
MW16
PA14
AL-9
MW48
AL-3
AL-5
MW14
MW2B
MW22
PAL2
MW47
MW23
MW34
PA47R2
PA60R
PA45R
PA63R
PA55R
PA61R
PA62R
PA53R
PA26R
BP73A
BP47B
PA58
PA52
PA57
PA59
BP67A
PA29
PA30
PA56
PA18
PA43
PA40
PA41
PZ4
PA13
PZ2
PZ20
PZ2A
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PZ8A
PA17
PZ7A
PZ7
PZ19A
PZ9
BP18A
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PZ10A
PZ10
BP3
MW-4
AL-1
MW36
MW-13A
AL-8
MW-1
MW5
MW-40
PA35
MWE
MWB
MWGB
MWA
MWG
PA-09
MW-6
MW7
MWC
AL-2
CEW-1
MW8
MWFB
MWFC
MW-11
MW2A
MWF
MW-3
MW10
PA-07
MW9A
MWD
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PZ14
PZ13
PZ12
PA20
PZ15
PA-08
LF19
PZ25
PZ29
LF18
BP19
LF16
S1
PZ5
EX7
PA19
PZ33
LF23
PZ1
EX2
LF15
LF17A
BP23
LF22
LEGEND
GROUNDWATER MONITORING WELL - ALLUVIUM
GROUNDWATER MONITORING WELL - ALLUVIUM AND FIRST SANTA CLARA FORMATION
GROUNDWATER MONITORING WELL - FIRST SANTA CLARA FORMATION
GROUNDWATER MONITORING WELL - SECOND SANTA CLARA FORMATION
GROUNDWATER MONITORING WELL - DEEPER SANTA CLARA FORMATION
PIEZOMETERS INSTALLED BY BROWN AND CALDWELL, ALLUVIUM
PIEZOMETERS INSTALLED BY BROWN AND CALDWELL, FIRST SANTA CLARA FORMATION
MATADERO CREEK MEASURING STAFF
PROPERTY BOUNDARY - WATKINS JOHNSON, 3333 HILLVIEW AVE.
ESTIMATED EXTENT OF SATURATED ALLUVIUM
HYDROGEOLOGIC DISCONTINUITY
OPERABLE UNIT BOUNDARY
0
200
400
APPROXIMATE SCALE IN FEET
SECOR
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LAFAYETTE, CALIFORNIA
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PREPARED FOR:
WJ COMMUNICATION, INC.
FORMER WATKINS-JOHNSON FACILITY
3301/3303/3305/3307 HILLVIEW AVENUE
PALO ALTO, CALIFORNIA
JOB NUMBER:
05OT.02787.00.0004
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RRR
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MS
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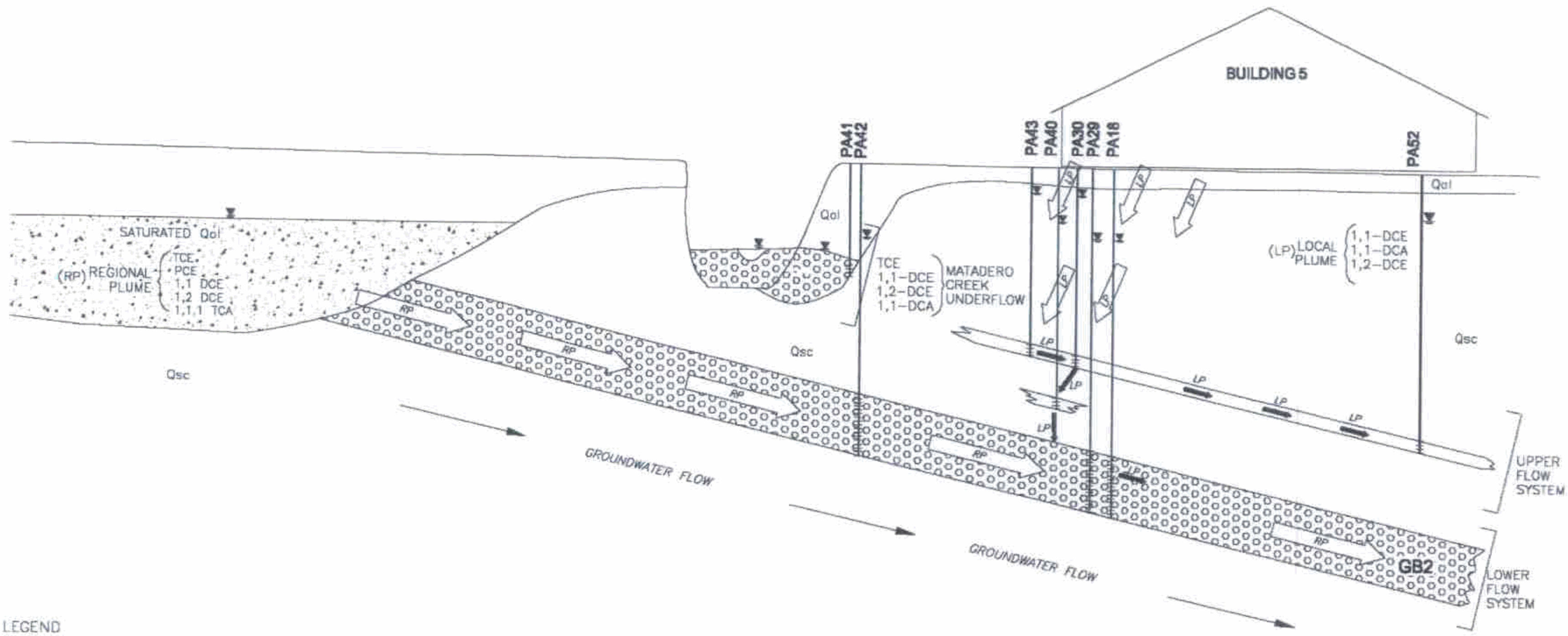
BEB
FORMER FACILITIES LAYOUT MAP
FIGURE:
2
DATE:
09/27/05



LEGEND

LP	LOCAL PLUME
RP	REGIONAL PLUME
Qal	QUATERNARY ALLUVIUM
Qsc	QUATERNARY SANTA CLARA FORMATION
	Qal/Qsc CONTACT
TCE	TRICHLOROETHENE
PCE	TECHRACHLOROETHENE
1,1 DCE	1,1 DICHLOROETHENE
1,2 DCE	1,2 DICHLOROETHENE
1,1 DCA	1,1 DICHLOROETHANE
PA42	MONITORING WELL ID AND SCREENED INTERVAL SATURATED GRAVEL BED
GB2	SATURATED GRAVEL BED SCREENED BY WELLS PA-18, PA-29 AND PA-42
	GROUNDWATER LEVEL

NOT TO SCALE

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CONCEPTUAL DIAGRAM OF HYDROGEOLOGY AND VOC TRANSPORT IN THE BUILDING 5 AREA

FIGURE: 3

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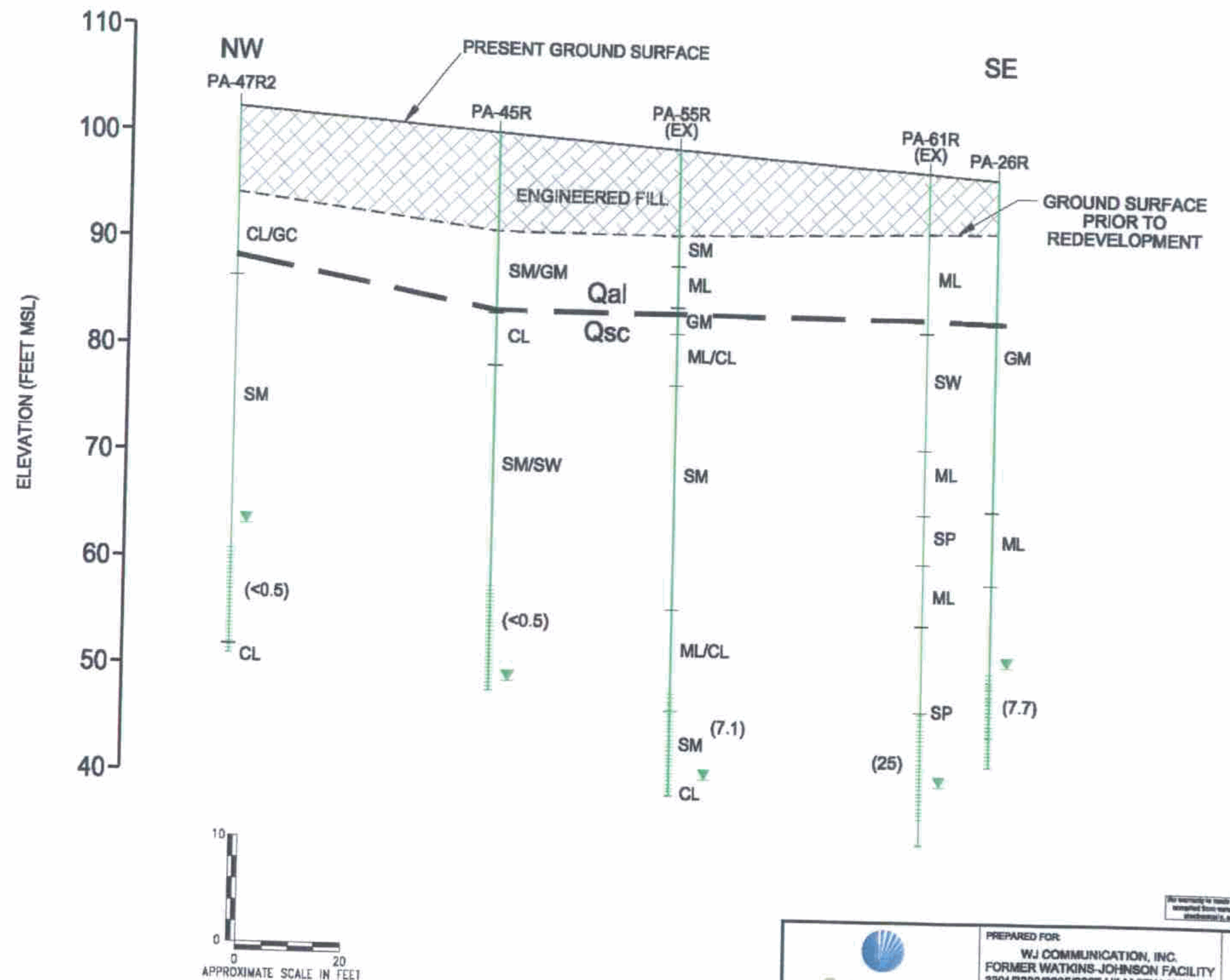
K:\Watkins-Johnson\Permanganate WP - 2005\WJ-Permanganate WP-2005-Figure 3.dwg modified by mrogasch at Jan 11, 2006 - 14:19



LEGEND

PA-47R — MONITORING WELL ID AND SCREENED INTERVAL

GROUNDWATER SURFACE

(EX) EXTRACTION WELL

(7.7) TCE CONCENTRATION IN NOVEMBER 2004 (μg/L)

CL/ML SOIL TYPE (USCS)

Qal QUATERNARY ALLUVIUM

Qsc QUATERNARY SANTA CLARA FORMATION

TCE TRICHLOROETHENE

Qal/Qsc CONTACT

SECOR 57 LAFAYETTE CIRCLE, 2nd FLOOR LAFAYETTE, CALIFORNIA Phone: (925) 299-9300 FAX: (925) 299-9302	PREPARED FOR: WJ COMMUNICATION, INC. FORMER WATKINS-JOHNSON FACILITY 3301/3303/3305/3307 HILLVIEW AVENUE PALO ALTO, CALIFORNIA	HYDROGEOLOGIC CROSS-SECTION BUILDING 6 AREA	FIGURE: 4
	JOB NUMBER: 05OT.02787.00.0004 / DRAWN BY: RRR	CHECKED BY: MS / APPROVED BY: BEB	DATE:

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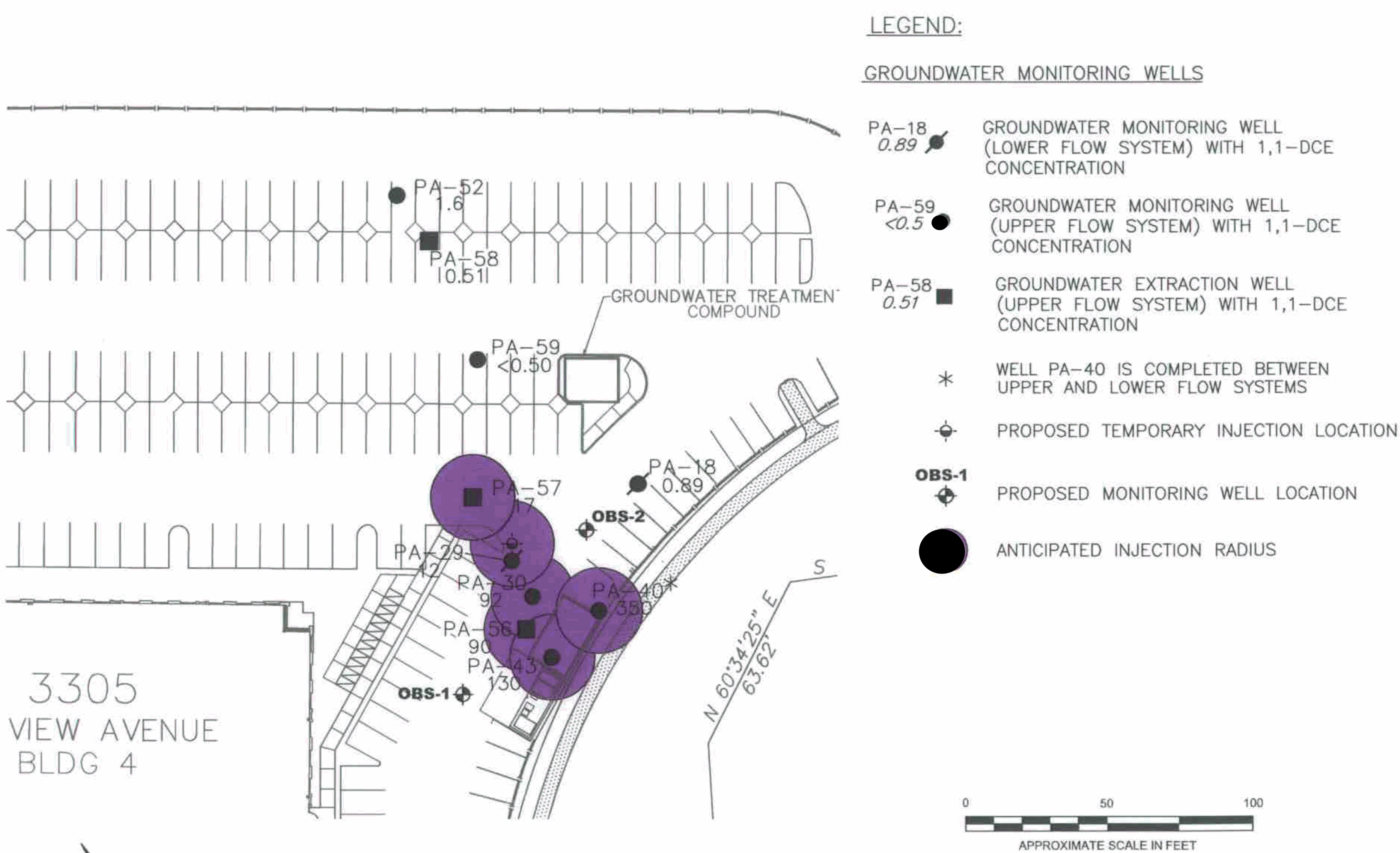

NOTE: 1,1-DCE DATA FROM NOVEMBER 2004

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PROPOSED INJECTION LOCATIONS
BUILDING 5

FIGURE: 5

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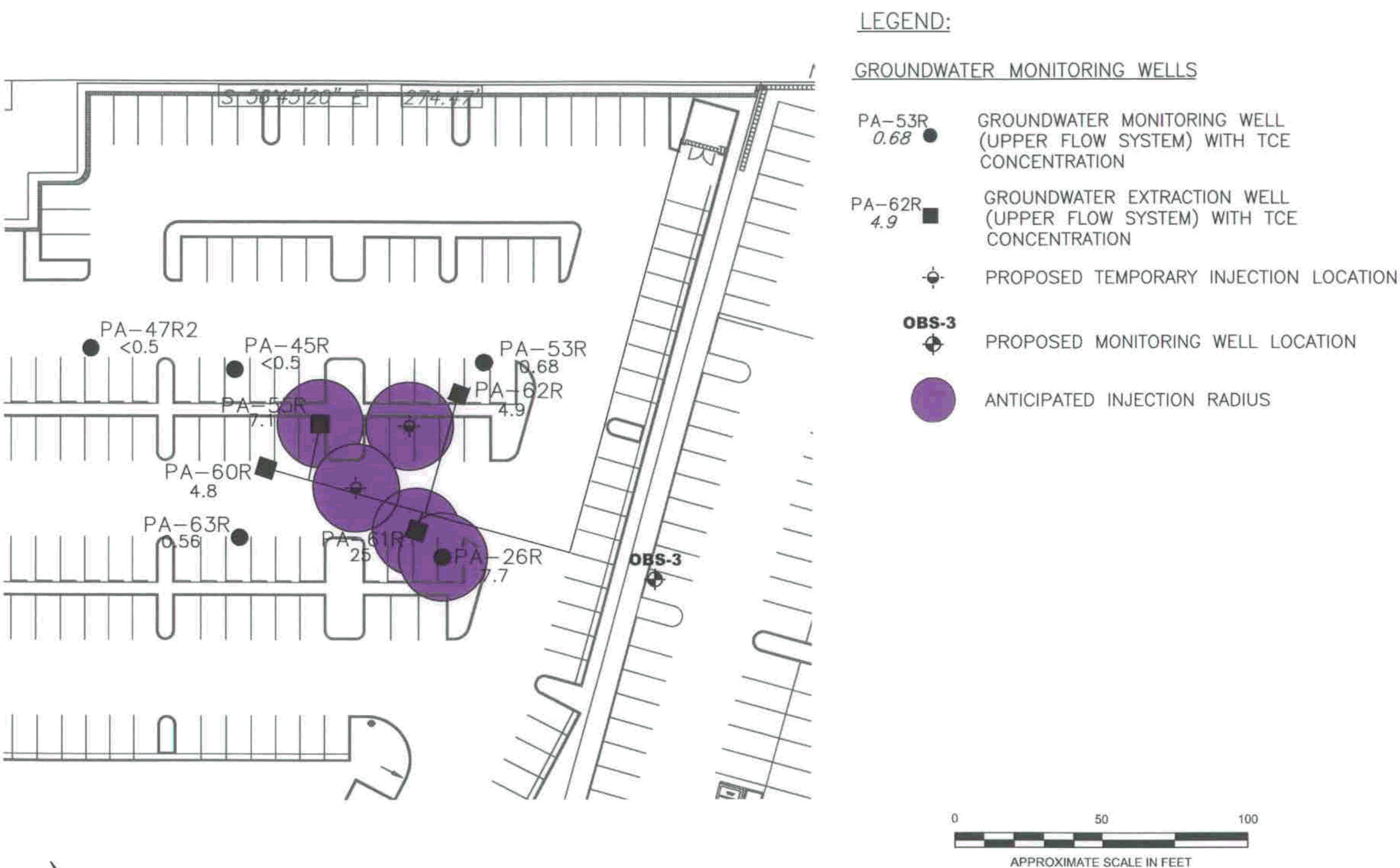
FILEPATH:K:\Watkins-Johnson\Permanganate WP - 2005\WJ-Permagenate WP-2005-Figure 5.dwg|rroggasch|Jan 13, 2006 at 14:38|Layout: Figure 5 BLDG 5



NOTE: TCE DATA FROM NOVEMBER 2004

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PROPOSED INJECTION LOCATIONS
BUILDING 6

FIGURE: 6

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FILEPATH:K:\Watkins-Johnson\Permanganate WP - 2005\WJ-Permagenate WP-2005-Figure 6.dwg|rroggasch|Jan 13, 2006 at 12:18|Layout: Fig 6 BLDG 6

Attachment 1

Low-Flow/Low Volume Purging and Sampling Standard Operating Procedure

Low-flow purging uses a pumping mechanism that produces low-flow rates (less than 1 liter per minute [lpm] or less than 0.26 gallons per minute [gpm]) that cause minimal drawdown of the static water table and employs a flow through cell in which geochemical parameters are continuously monitored. These parameters will include dissolved oxygen, oxidation-reduction potential (ORP), conductivity, turbidity and/or pH. The procedures for low-flow purging and sampling will follow guidance in U.S. Environmental Protection Agency (EPA) publication EPA 540/S-95/504, *Low-Flow (Minimal Draw Down) Groundwater Sampling Procedures (April 1996)*.

The intent of this sampling protocol is to collect a representative sample from the monitored groundwater zone. A representative sample may be obtained when all the monitored chemical parameters have stabilized, thus, qualitatively demonstrating that the groundwater being purged is in equilibrium. Samples are collected directly from the pumping mechanism with minimum disturbance to the aquifer groundwater. The low-flow/low volume purging method (purging to parameter stability) tends to isolate the interval being sampled, which provides more accurate water quality measurements and reduces the volume of purge water generated.

Purging

Each well will be gauged, then purged prior to sample collection. Wells will be purged with a device that does not compromise the sample by cross-contamination, aeration, or other negative effects. An submersible electric pump or pneumatic bladder pump, capable of controlling discharge flow to 1.0 lpm or less, will be used for purging. The pump intake will be set at a depth corresponding to the approximate midpoint of the saturated screened interval of each well. The pump intake depth for each well will be recorded so that the depth setting can be reproduced in subsequent sampling events. The pump and affected piping will be decontaminated between each use or dedicated for that well. The wells with expected lower contamination levels will be purged and sampled first.

Low-flow refers to the velocity of the water entering the pump intake. Low-flow purging also results in limited drawdown. The well will be purged at a constant low-flow rate of 0.1 to 1.0 lpm with an overall goal of less than 0.33 feet of drawdown in the well during purging. The groundwater depth measurement device used will be capable of measuring to within 0.01 foot accuracy.

The flow rate used during purging must be low enough to avoid increasing the water turbidity. The following measures will be taken to determine the appropriate flow rate:

- The flow rate shall be determined for each well, based on the hydraulic performance of the well.

- The flow must be adjusted to obtain stabilization of the water level in the well as quickly as possible.
- The maximum flow rate used should not exceed 1 lpm.
- Once established, this rate should be reproduced with each subsequent sampling event.
- If a significant change in initial water level occurs between events, it may be necessary to re-establish the optimum flow rate at each sampling event.

The goal is to achieve a stabilized pumping water level as quickly as possible with minimal drawdown to avoid stressing the formation and mobilizing solids and to obtain stabilized indicator parameters in the shortest time possible. Continuous monitoring of water quality indicator parameters is used to determine when purging is completed and sampling should begin. Stabilized values, based on selected criteria will be met prior to sampling. The use of an in-line flow-through cell (closed) system will be used for measuring indicator parameters, except for turbidity. A separate field nephalometer will be used to measure turbidity.

Measurements will be taken each 3 to 5 minutes and water chemistry parameters are considered to be stable when they are within the following ranges for three consecutive readings:

Dissolved Oxygen (DO)	+/- 0.2 mg/L
ORP	+/- 20 mv
Turbidity	+/- 10 percent
Specific Conductance	+/- 3-5 percent
Temperature	+/- 3 percent
pH	+/- 0.2 units

Sampling

After the well has been properly purged as described above, a groundwater sample will be collected. The same pumping device used for purging will be used for sampling. Groundwater samples will be collected directly from the discharge tubing. Samples will be collected in appropriate bottles, packaged, and transported under chain-of-custody to a California-certified laboratory for analysis.